

## 1      What is claimed is:

2      1. A wellbore fluid comprising:

3 an aqueous based continuous phase;

4 a viscoelastic surfactant; and

5 a surfactant-polymer compound soluble in an aqueous solution, the surfactant-  
6 polymer compound having a hydrophobic backbone and a plurality of hydrophilic  
7 functional groups attached to the hydrophobic backbone,

8 wherein the hydrophobic backbone is the reaction product of one or more  
9 molecules having polymerizable alkene or alkyne functional groups;

wherein the hydrophilic functional groups are selected from: zwitterionic surfactant functional groups, anionic surfactant functional groups, cationic surfactant functional groups, and nonionic surfactant functional groups; and,

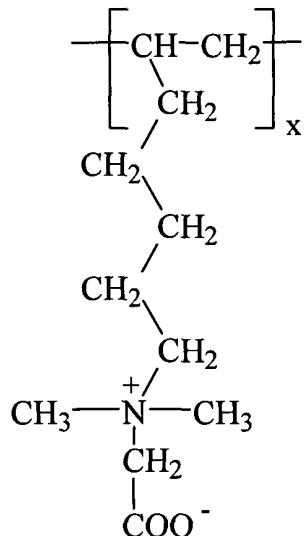
wherein the combination of the viscoelastic surfactant and surfactant-polymer compound form micellar assemblies.

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16 2. The wellbore fluid of claim 1 further comprising a water-soluble inorganic salt.

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18 3. The wellbore fluid of claim 1 wherein the acid form of the surfactant-polymer  
19 compound has the structure:



1       wherein x = 2 to 300,000.

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3       4. The wellbore fluid of claim 3 wherein x = 2 to 36.

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5       5. The wellbore fluid of claim 1 wherein the surfactant-polymer compound is a salt of  
6       oligo- or poly-( $\alpha$ -alkenyl - $\omega$ - or  $\alpha$ -alkynyl - $\omega$ -quaternary-ammonio-N,N-dialkyl-N-  
7       alkylcarboxylate) or a mixture further comprising a salt of N-alkyl-N-carboxymethyl-  
8       N,N-dimethylammonium chloride.

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10      6. The wellbore fluid of claim 1 wherein the surfactant-polymer compound is a salt of  
11       oligo- or poly-(1-hepten-7-quaternary-ammonio-N,N-dimethyl-N-methylcarboxylate) or  
12       a mixture further comprising a salt of N-hexadecyl-N-carboxymethyl-N,N-  
13       dimethylammonium chloride.

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15      7. The wellbore fluid of claim 1 wherein the surfactant-polymer compound is a salt of  
16       oligo- or poly-( $\alpha$ -alkenyl - $\omega$ - or  $\alpha$ -alkynyl - $\omega$ -quaternary-ammonio-N,N-dialkyl-N-  
17       alkylcarboxylate).

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19      8. The wellbore fluid of claim 1 wherein the surfactant-polymer compound is a salt of  
20       oligo- or poly-(1-hepten-7-quaternary-ammonio-N,N-dimethyl-N-methylcarboxylate).

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22      9. A wellbore fluid comprising:

23           an aqueous fluid;

24           a viscoelastic surfactant;

25           a thickener soluble in the aqueous fluid,

26        wherein the thickener has a hydrophobic oligomeric or polymeric backbone made  
27        from the reaction of alkene monomer or alkyne monomer, or mixtures thereof, and

28           wherein surfactant functional groups are attached to the hydrophobic backbone,  
29        wherein the surfactant functional group is selected from: zwitterionic surfactant  
30        functional groups, anionic surfactant functional groups, cationic surfactant functional  
31        groups, and nonionic surfactant functional groups; and,

1       wherein the thickener has a molecular confirmation such that the surfactant  
2       functional groups are hydrophilic and the hydrophobic oligomeric or polymeric backbone  
3       is hydrophobic; and

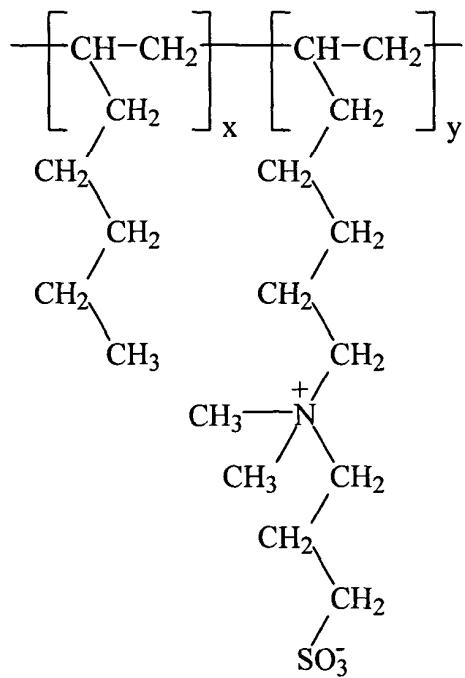
4               wherein the combination of viscoelastic surfactant and thickener form micellar  
5       assemblies such that the wellbore fluid thickener develops viscoelastic characteristics.

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7       10. The wellbore fluid of claim 9 wherein the thickener has the following structure:

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10       wherein x + y = 2 to 300,000.

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12       11. The wellbore fluid of claim 10 wherein x + y = 2 to 36.

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14       12. The wellbore fluid of claim 11 wherein the thickener is a salt of oligo- or poly-( $\alpha$ -  
15       alkene - $\omega$ - or  $\alpha$ -alkyne-co- $\alpha$ -alkenyl - $\omega$ - or  $\alpha$ -alkynyl - $\omega$ -quaternary-ammonio-N,N-  
16       dialkyl-N-alkylsulfonate).

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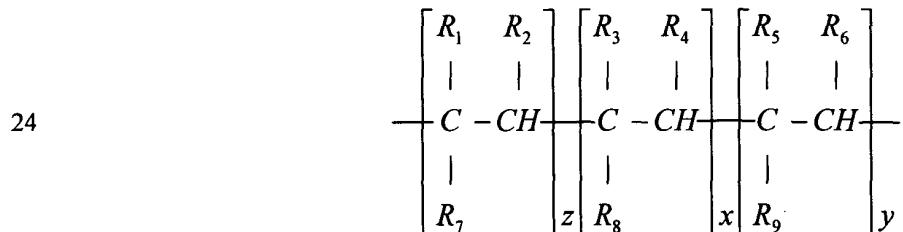
1       13. The wellbore fluid of claim 11 wherein the thickener is oligo- or poly-(1-heptene-co-  
2       1-hepten-7-quaternary-ammonio-N,N-dimethyl-N-propylsulfonate).

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4       14. The wellbore fluid of claim 9 wherein the viscoelastic surfactant is selected from the  
5       following: anionic, nonionic, amphoteric, zwitterionic, alcohols, alkano-lamides,  
6       alkanolamines, alkylaryl sulfonates, alkylaryl sulfonic acids, amine acetates, amine  
7       oxides, amines, sulfonated amines, sulfonated amides, betaines, block polymers,  
8       carboxylated alcohols, alkylphenol ethoxylates, carboxylic acids, fatty acids, ethoxylated  
9       alcohols, ethoxylated alkylphenols, ethoxylated amines, ethoxylated amides, ethoxylated  
10      fatty acids, ethoxylated fatty esters, fatty esters, fluorocarbon-based surfactants, glycerol  
11      esters, glycol esters, heterocyclic surfactants, imidazolines, isethionates, lanolins,  
12      lechithins, methyl esters, monoglycerides, olefin sulfonates, phosphate esters,  
13      polyethylene glycols, polysaccharides, polyacrylic acids, polyacrylamides, propoxylated  
14      alcohols, propoxylated alkylphenols, propoxylated amines, propoxylated amides,  
15      propoxylated fatty acids, propoxylated fatty esters, protein-based surfactants, quaternary  
16      surfactants, sarcosamines, silicone-based surfactants, soaps, sodium isethionate,  
17      sorbitans, sucrose and glucose esters, sulfates and sulfonates of oils and fatty acids,  
18      sulfates and sulfonates of ethoxylated alkylphenols, sulfates of alcohols, sulfates of  
19      ethoxylated alcohols, sulfates of fatty esters, sulfonates of hydrocarbons and petroleum,  
20      sulfosuccinates, taurates, and tridecyl and dodecyl benzene sulfonic acids and mixtures  
21      thereof.

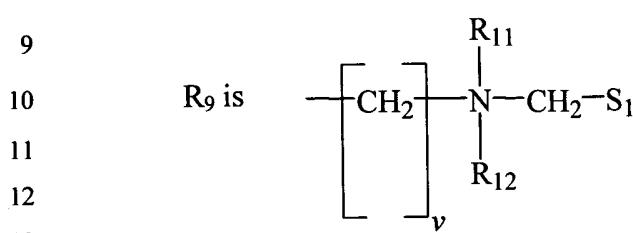
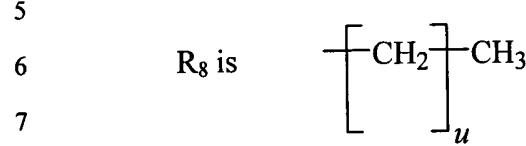
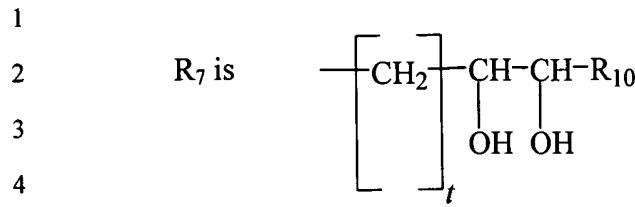
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23       15. The wellbore fluid of claim 9 wherein the thickener has the following structure:



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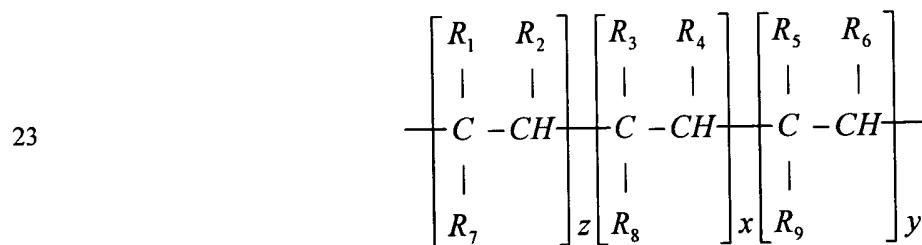
27       where  $R_1, R_2, R_3, R_4, R_5, R_6 = H$  or  $CH_3$



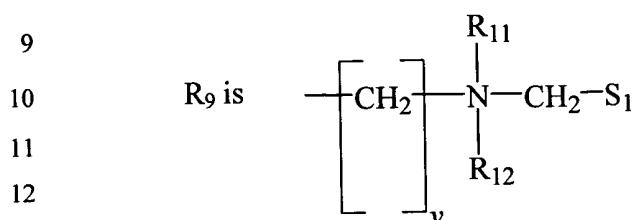
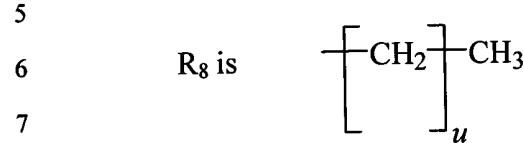
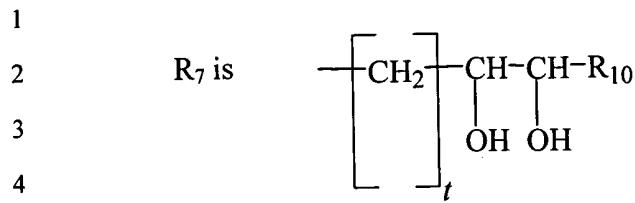
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15     wherein R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub> = H or CH<sub>3</sub>, and t = 1 to 16, u = 6 to 12, v = 1 to 18, w = 1 to 3,  
16     and x + y + z = 3 to 300,000 and S<sub>1</sub> = CO<sub>3</sub><sup>-</sup> or SO<sub>4</sub><sup>-</sup>.

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18     16. The wellbore fluid of claim 15 wherein t = 12 to 16, u = 6 to 12; v = 12 to 18, w = 1  
19     to 3, x = 0 to 10,000, y = 2 to 300,000 and z = 0 to 10,000

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21     17. The wellbore fluid of claim 9 wherein the oligomer or polymer has the following  
22     structure:



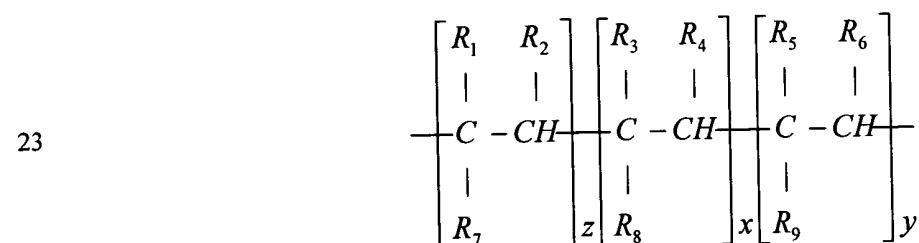
26     wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub> = H or CH<sub>3</sub>



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15     wherein R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub> = H or CH<sub>3</sub>, t = 1 to 16, u = 6 to 12, v = 1 to 18, and x + y + z = 3 to  
16     300,000.

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18     18. The wellbore fluid of claim 17 wherein t = 12 to 16, u = 6 to 12, v = 12 to 18, w = 1  
19     to 3, and x = 0 to 10,000, y = 2 to 300,000, and z = 0 to 10,000.

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21     19. The wellbore fluid of claim 9 wherein the oligomer or polymer has the following  
22     structure



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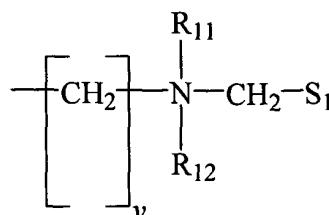
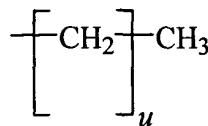
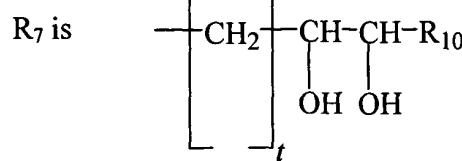
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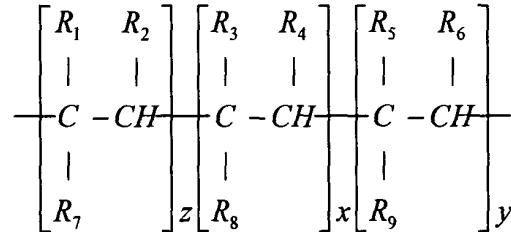
wherein R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub> = H or CH<sub>3</sub>, t = 1 to 16, u = 6 to 12, v = 1 to 18, x + y + z = 3 to 300,000, and S<sub>1</sub> = CO<sub>3</sub><sup>-</sup> or SO<sub>4</sub><sup>-</sup>.

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20. The wellbore fluid of claim 19 wherein t = 12 to 16, u = 6 to 12, v = 12 to 18, x = 0 to 10,000, y = 2 to 300,000, and z = 0 to 10,000.

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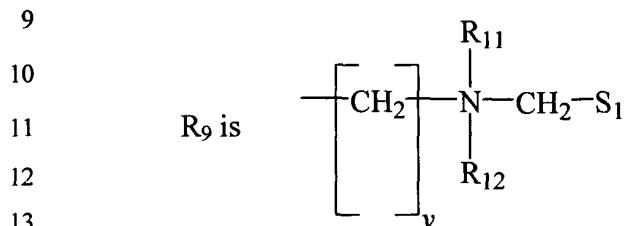
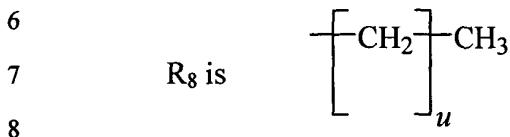
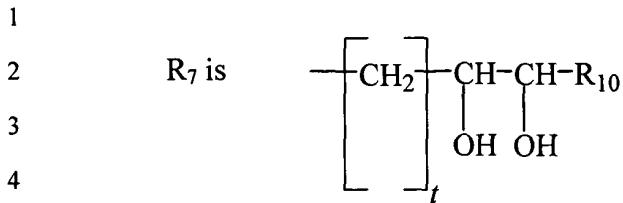
21. The wellbore fluid of claim 9 wherein the oligomer or polymer has the following structure:



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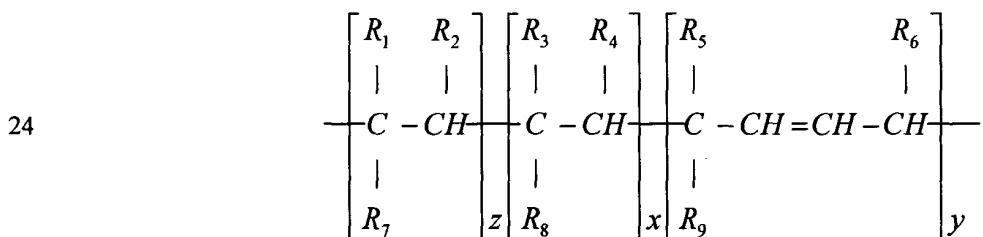
28. wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub> = H or CH<sub>3</sub>



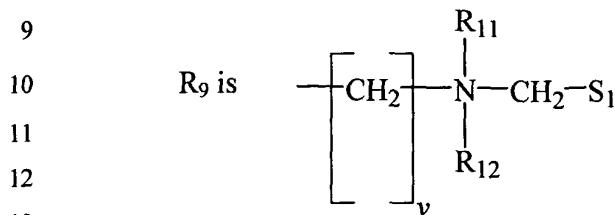
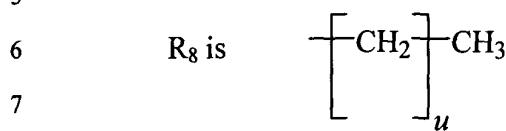
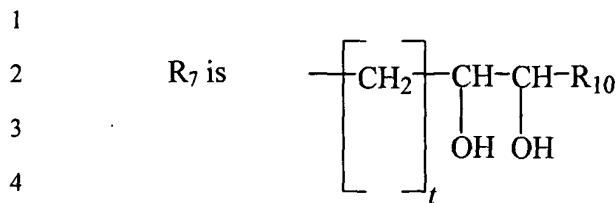
14  
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16     wherein, R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub> = H or CH<sub>3</sub>, t = 1 to 16, u = 6 to 12, v = 1 to 18, w = 1 to 12, and x + y + z = 3 to 300,000.

18  
19     22. The wellbore fluid of claim 21 wherein t = 12 to 16, u = 6 to 12, v = 12 to 18, w = 1 to 3, and x = 0 to 10,000, y = 2 to 300,000, and z = 0 to 10,000.

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22     23. The wellbore fluid of claim 9 wherein the oligomer or polymer has the following structure:



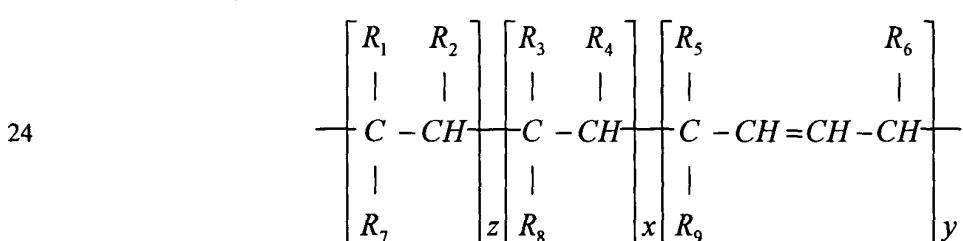
26     wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub> = H or CH<sub>3</sub>



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15  
16     wherein R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub> = H or CH<sub>3</sub>, and t = 1 to 16, u = 6 to 12, v = 1 to 18, w = 1 to 3,  
17     and x + y + z = 3 to 300,000 and S<sub>1</sub> = CO<sub>3</sub><sup>-</sup> or SO<sub>4</sub><sup>-</sup>.

18  
19     24. The wellbore fluid of claim 23 wherein t = 12 to 16, u = 6 to 12; v = 12 to 18, w = 1  
20     to 3, x = 0 to 10,000, y = 2 to 300,000 and z = 0 to 10,000

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22     25. The wellbore fluid of claim 9 wherein the oligomer or polymer has the following  
23     structure:



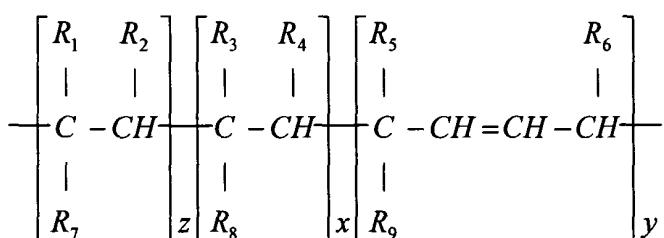
wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub> = H or CH<sub>3</sub>

5                            R<sub>8</sub> is                             $\left[ \text{CH}_2 \right]_u \text{CH}_3$   
 6  
 7

wherein R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub> = H or CH<sub>3</sub>, t = 1 to 16, u = 6 to 12, v = 1 to 18, and x + y + z = 3 to 300,000.

19       28. The wellbore fluid of claim 25 wherein  $t = 12$  to  $16$ ,  $u = 6$  to  $12$ ,  $v = 12$  to  $18$ ,  $w$   
20       =  $1$  to  $3$ , and  $x = 0$  to  $10,000$ ,  $y = 2$  to  $300,000$ , and  $z = 0$  to  $10,000$ .

21  
22 27. The wellbore fluid of claim 9 wherein the oligomer or polymer has the following  
23 structure:



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26  
27 wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub> = H or CH<sub>3</sub>

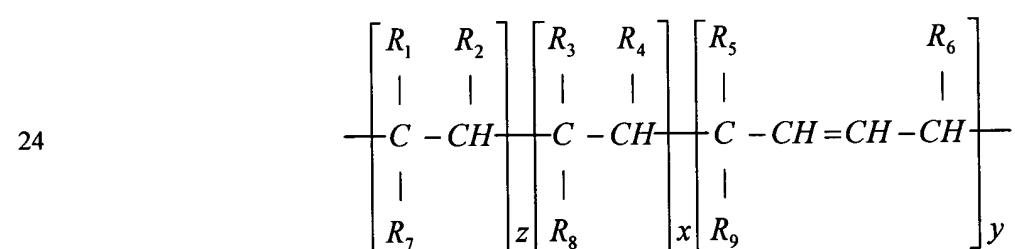
5                    R<sub>8</sub> is        
 6  
 7

8  
9  
10 R<sub>9</sub> is      

wherein R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub> = H or CH<sub>3</sub>, t = 1 to 16, u = 6 to 12, v = 1 to 18, x + y + z = 3 to 300,000, and S<sub>1</sub> = CO<sub>2</sub><sup>-</sup> or SO<sub>3</sub><sup>-</sup>.

18  
19 28. The wellbore fluid of claim 27 wherein  $t = 12$  to  $16$ ,  $u = 6$  to  $12$ ,  $v = 12$  to  $18$ ,  $w = 1$   
20 to  $3$ , and  $x = 0$  to  $10,000$ ,  $y = 2$  to  $300,000$ , and  $z = 0$  to  $10,000$ .

21  
22 29. The wellbore fluid of claim 9 wherein the oligomer or polymer has the following  
23 structure:



27 wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub> = H or CH<sub>3</sub>

1  
2      R<sub>7</sub> is       $\left[ \text{CH}_2 \right]_t \text{CH}(\text{OH})\text{CH}(\text{OH})\text{R}_{10}$   
3  
4  
5

6      R<sub>8</sub> is       $\left[ \text{CH}_2 \right]_u \text{CH}_3$   
7  
8

9      R<sub>9</sub> is       $\left[ \text{CH}_2 \right]_v \text{N}(\text{R}_{11})(\text{R}_{12})\text{CH}_2\text{S}_1$   
10  
11  
12  
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14  
15      wherein, R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub> = H or CH<sub>3</sub>, t = 1 to 16, u = 6 to 12, v = 1 to 18, w = 1 to 12, and x  
16      + y + z = 3 to 300,000.

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18      30. The wellbore fluid of claim 29 wherein t = 12 to 16, u = 6 to 12, v = 12 to 18, w = 1  
19      to 3, and x = 0 to 10,000, y = 2 to 300,000, and z = 0 to 10,000.

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21      31. The wellbore fluid of claim 9 wherein the oligomers or polymers are crosslinked  
22      with polyvalent metal ions, formaldehyde, or glutaraldehyde.

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24      32. The wellbore fluid of claim 31 wherein the polyvalent metal ions are selected from  
25      the following: Fe<sup>2+</sup>, Cd<sup>2+</sup>, Co<sup>2+</sup>, Ca<sup>2+</sup>, Cu<sup>2+</sup>, UO<sub>2</sub><sup>2+</sup>, PbO<sup>2+</sup>, Al<sup>3+</sup>, Fe<sup>3+</sup>, Cr<sup>3+</sup>, Ce<sup>3+</sup>, Ti<sup>4+</sup>,  
26      Zr<sup>4+</sup>, Sn<sup>4+</sup> and mixtures thereof.

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28      33. A method of making a wellbore fluid comprising blending:  
29              an aqueous fluid phase;  
30              a viscoelastic surfactant;  
31              a water-soluble inorganic salt;

1           an oligomer or polymer soluble in an aqueous salt solution, the oligomer or  
2       polymer comprising a hydrophobic oligomeric or polymeric backbone made from the  
3       oligomerization or polymerization of alkene or alkyne monomer groups, or mixtures  
4       thereof, the oligomer or polymer further comprising zwitterionic functional groups  
5       attached to the hydrophobic backbone, wherein the oligomer or polymer is hydrophilic in  
6       the zwitterionic functional groups and hydrophobic in the backbone hydrocarbon chain to  
7       form micellar assemblies such that the oligomers or polymers develop viscoelastic  
8       character prior to a polymerization step.

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10      34. The method of claim 33 further comprising a polymerization step of the polymer or  
11     oligomer, then drying the product and subsequently admixing it into a solution of  
12     conventional surfactants.

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14      35. A method of drilling a subterranean well, the method comprising:  
15           drilling the subterranean well using a rotary drilling rig and circulating a drilling  
16           fluid in the subterranean well, wherein the drilling fluid is the wellbore fluid of claim 1.

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18      36. A method of reducing the loss of fluid out of a subterranean well, the method  
19           comprising injecting into the subterranean well a wellbore fluid as recited in claim 1.

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